Anthropic Impacts on Ecosystem Dynamics in Nearshore Chesapeake Bay Environments

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Abstract

The decline of subaqueous aquatic vegetation (SAV) in nearshore Chesapeake Bay environments has been well documented, largely due to water-quality issues. However, oceanographic (i.e., shoreline and sea level rise), wind-driven effects also can be responsible (e.g., temperature, salinity, oxygen, sediment input and accumulation rates). These effects are variable in both nature and in their relative contribution to the sedimentary record. Radiochemical (210Pb) and textural (grain size, organic content) properties are examined in the spatial (m-km) and temporal (~100 y) scales, and resulting potential impacts to SAV communities. We focus on sites that are susceptible to natural and anthropogenic perturbations. In order to better understand how subaqueous aquatic vegetation (SAV) responds to these changes, we have examined the spatial and temporal trends in the sedimentary record behind and adjacent to offshore segmented breakwaters. The authors would like to thank NOAA Chesapeake Bay Office and the Army Corps of Engineers for funding this study. We also thank Dale Kickel for invaluable field and laboratory assistance, as well as Carter Baehringer and Taylor Felbinger for generating some of the data shown.

Segmented Breakwaters

To address sedimentological changes associated with breakwater construction, two breakwaters were chosen for study and sampled via aerial photography in 2000. Block 2 was constructed in 1995 in a structurally segmented breakwater. The area behind the breakwater in the 2007 image is likely SAV; the waves are likely surface waves that could be due to rapid deposition or mixing (likely physical as few infauna were observed). It is not included in the accumulation rate calculations. The 2005 profile can be correlated to 2005 SAV; older points with steady-state sedimentation and an open portion with more variable sedimentation. This bed is likely to be surface waves; several points indicate a transition upward, with the fine component ~20% below ±1 cm at the surface. The core behind the breakwater also has a relatively coarse component less than 0.1 mm size. Grain-size transitions are apparent in the top of the core, with a ~25 cm thick surficial layer. The layer is relatively uniform (~90%), which could be due to surface water physical or fine activity. This shows an increase in the accumulation rate calculations. This profile can be correlated to 2000 SAV; older points with steady-state sedimentation and an open portion with more variable sedimentation. This bed is likely to be surface waves; several points indicate a transition upward, with the fine component ~20% below ±1 cm at the surface. The core behind the breakwater also has a relatively coarse component less than 0.1 mm size. Grain-size transitions are apparent in the top of the core, with a ~25 cm thick surficial layer. The layer is relatively uniform (~90%), which could be due to surface water physical or fine activity.

Stable versus Declining Beds

Comparing sites with relatively stable SAV beds and those that have relatively supported SAV beds may not be promising for vegetated (210Pb) may lend insights into why some areas of Chesapeake Bay are previously vegetated despite meeting the water column requirements. In the Chesapeake Bay region, however, SAV beds typically are comprised of >65% of the (material) and have lower accumulation rates (~5 mm/y). The SAV was observed in the sheltered areas (~3 cm) with the surficial sand layer of ~3 cm observed that decreases to ~2 cm in 2008. This suggest that subaqueous aquatic vegetation (SAV) responds to these changes when associated with offshore segmented breakwaters. The authors would like to thank NOAA Chesapeake Bay Office and the Army Corps of Engineers for funding this study. We also thank Dale Kickel for invaluable field and laboratory assistance, as well as Carter Baehringer and Taylor Felbinger for generating some of the data shown.

Study Sites

Northern Chesapeake Bay

- Stable Sites
- Declining Beds
- Breakwaters

1 = Crab Alley Bay
2 = Trippe Bay
3 = Casson Point
4 = Herring Bay
5 = EN 6 = Eastern Neck

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